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Menoher, chief. The aviator was Sergeant T. J. Fowler. The photographic equipment consisted of a mapping camera, K.1 model, fixed in the bottom of the plane. This camera is designed to take successive pictures automatically and can be so adjusted for the altitude of the plane and the apparent air speed that the exposures take a small overlap. The views can therefore be combined in a continuous mosaic. Theoretically the action should be perfect and the continuity of the pictures unbroken. In practise, the tilting of the plane is equivalent to turning a camera through a greater or less angle on a tripod and successive views may jump interspaces of greater or less extent. One remedy, with this type of camera, would be to repeat, a recourse which is practicable when flying over a restricted area, but impracticable in a flight between distant landing fields. A clinometer would enable the photographer to note the inclination of the plane and a finder might be used.

The flights here noted covered a course of approximately 400 miles each way and were made in 4 hours 40 minutes on the southward trip and 4 hours 13 minutes on the northward.

The San Andreas Rift, the object of observation, is that major continental structure which extends from Humboldt County in northern California to the Mohave Desert in the southern part of the state, a distance of about 600 miles. It is an ancient fault, the locus of innumerable movements, which have given rise to pronounced topographic features. Displacements have been upward or downward or lateral along different sections of the fault or during different movements along the same section. We have yet much to learn about the effects of faulting expressed in the details of geology along the rift.

The earthquake of April, 1906, produced marked surface features, which were carefully studied by Branner, Gilbert, Lawson and other geologists and which have been fully described in the report of the California State Earthquake Commission, publication 87 of the Carnegie Institution of Washington. One is often asked to what extent those features are still

"mustard gas," the reply was:— "Why are you worrying about this when you know perfectly well that this is not the gas we shall use in the next war?"

I hold no brief for preventive medicine, which is well able to fight its own case. I would only say that it is the legitimate business of preventive medicine to preserve by all known means the health of any body of men, however large or small, committed to its care. It is not to its discredit if, by knowledge and skill, the numbers so maintained run into millions instead of being limited to thousands. On the other hand, "an educated public opinion" will refuse to give credit to any body of scientific men who employ their talents in devising means to develop and perpetuate a mode of warfare which is abhorrent to the higher instincts of humanity.

This association, I trust, will set its face against the continued degradation of science in thus augmenting the horrors of war. It could have no loftier task than to use its great influence in arresting a course which is the very negation of civilization.

T. EDWARD THORPE

AERIAL OBSERVATION OF EARTHQUAKE RIFTS

THE Seismological Society of America is interested in mapping the earthquake rifts of California, with a view to increasing our knowledge of the structures related to earthquakes and to promoting security in the engineering work of the state. Data of a general and comprehensive character already exist in published and unpublished maps, but additional surveys are desirable. Faults may be located in several ways and it is possible that a method of tracing them may be developed with the airplane, as was first suggested to the writer by H. O. Wood. To test the idea, a flight was made by me from San Francisco to Los Angeles and return on June 9 and 11, so far as practicable over the San Andreas Rift, to observe and photograph it.

The plane was furnished by the Air Service of the U. S. Army, by courtesy of Major H. H. Arnold, under authority of General C. T.

visible and the answer is that much depends upon the climatic conditions of any selected section. Where rainfall is abundant, vegetation vigorous and erosion efficient, there is not much to be seen after fifteen years; but under arid conditions the marks of the disturbance of 1857 survive plainly.

The essential fact is that the Rift is a line, and features peculiar to it must fall into line. The general position and course of this Rift being known, the observer was constantly noting valleys, lakes and ponds, ravines, washes or scars on the surface, which lined up with one another. From over Mussel Rock, where the Rift cuts the shore, the range along the Rift was plainly that of the axis of San Andreas and Crystal Springs Lakes, and was continued in the valley through Searles Lake and beyond to Black Mountain. Stevens Creek heads in that summit on the Rift, and flows for six miles along it. Thus for a distance of 33 miles the earthquake line is marked by major features of the topography, by valleys which are due to the cooperation of displacement and erosion. Similar valleys might be produced by erosion alone, and since the rocks are hidden by water, soil and vegetation, the aerial observer could not see the displacement. In this section the observer could infer, but could not demonstrate the existence of the Rift.

Continuing southeastward beyond Wright's Station on the Santa Cruz branch of the Southern Pacific the Rift traverses the western slope of the Santa Cruz Mountains near the summit, and determines the course of numerous small valleys which are the head-valleys of streams that flow south to Monterey Bay, but which contrary to what would be expected, range themselves into line parallel with the crest of the mountains. Along this same line there are numerous landslide scars and small ponds. No one or small group of these features would necessarily indicate the existence of the Rift, but their alignment over a distance of 25 miles would be strong presumptive evidence of it, and that alignment can be seen from the airplane. The only other way in which it can be demonstrated is by a

study of an accurate topographic map, which is in itself, as it were, an airplane view. Thus for any section of an earthquake track which might be indicated by features similar to those occurring on the western slopes of the Santa Cruz Mountains observation by airplane would constitute a valuable method of investigation.

Passing to the middle section of the earthquake Rift where the aridity of the climate prevents the growth of vegetation, and limits the destructive work of erosion, the marks of the earthquake became more distinct and more continuous. Thus my notes read: "Mustang Ridge and Peach Tree Valley, Rift shows in serpentine slides in the ridge. Temblor Range, the line of the Rift shows like a light soil streak for miles ahead. Over Carrizo Plains at Wolforts, Rift shows up in a line of white washes easily lined up," and a little further along: "Rift shows plainly like a canal ditch."

The ditch-like character of the Rift along the northeast slope of Carrizo Plain has been noted by Fairbanks and others. It is remarkable, plainly visible from an altitude of 12,000 feet, like a large empty irrigation canal. I could see it perhaps 10 miles ahead till it was lost in the rosy dust haze.

At this point the aviator passed me a note: "Forty minutes more gas." I scaled off the distance to Bakersfield, the only landing place. It was 35 minutes away and we turned from the Rift.

Returning from Los Angeles on the 11th we flew along the southeastern section of the Rift from Tejon Pass up Cuddy Valley to San Emidio Peak. In this stretch it is marked by springs which give rise to alkali patches or to green mallins, the marshes peculiar to seepages in arid valleys. Its features are easily traceable because of their linear continuity.

Photographing from an airplane is less satisfactory than observing. When the camera is fixed on the plane, as it must be to secure continuity of views, there is the trouble of swinging already referred to. I myself lost the sense of horizontal or vertical and was

quite unconscious of the fact that the camera was winking at the mountain slope when I thought it was photographing the lake.

In the vertical view features are flattened. This is true for vision and is even more pronouncedly true in photographs. It would be desirable therefore to observe during the earlier and later hours of the day when shadows are strong. The swiftness of flight makes this practicable, since miles become short when expressed in minutes and a distant field of study can be reached quickly. Photography, however, requires the strongest light possible because the exposure must be very brief when the camera is moving a hundred miles an hour, and this requirement limits the available hours to those when shadows are weak or lacking. The effect of this limitation is yet to be worked out, but since rift features are to a great extent relief features, it is of consequence.

So far as the trial flights of June 9 and 11 go they seem to demonstrate that aerial observation of a linear structural feature such as an earthquake rift is practicable. If one end of a rift be known it can be followed by a man skilled in the interpretation of topographic forms. Or if a line of features be detected, it may be so traced as to demonstrate their continuity and to facilitate the closer examination which may be necessary to prove the existence of a fault. I conclude that the airplane can be used to advantage as a means of rapid geologic reconnaissance to map large structural features.

BAILEY WILLIS

SCIENTIFIC EVENTS

INTERNATIONAL EXPLORATION OF THE UPPER AIR¹

INTERNATIONAL exploration of the upper air dates from 1896, when a conference took place at Petrograd. Methods of sounding the atmosphere, even to a height of 23 miles, were devised. By the use of drifting free balloons, and recording instruments carried up by kites and anchored balloons, an unexpected stratification of the atmosphere has been discovered. The temperature falls regularly up to a height averaging six or seven miles from the ground,

¹ From the *London Times*.

lower over the equator, higher near the poles. But the upper air is arranged in vertical columns in which the temperature is constant with height at any particular time and place. Little is known as to the cause of this disposition, and less as to the influence it must have on other factors of wind and weather. Useful knowledge can be gained only from data obtained by the same methods at the same times at the largest possible number of stations. International cooperation is necessary. It was interrupted by the war, although all the combatants made extensive use of the latest meteorological methods for the practical objects of artillery, aviation, poison gas, and sound-ranging. It has now been resumed. The other day we gave an account of the proceedings of the first meeting since the war, held at Bergen, in the last week of July, under the presidency of Professor V. Bjerknes. The name of that distinguished Norwegian meteorologist is associated with a new theory of the weather in temperate latitudes, on which we commented a year ago. The theory briefly is that just as the poles are capped with snow so they are capped by a great mass of cold air. In a wavering line round each temperate zone this polar air meets the warm air from the equator abruptly. Along the front of contact the warm air rises over the cold stream. Cyclones and anticyclones are born of the contest. The professor urges the formation of a closely set chain of observing stations round the globe in the zone of struggle. Other meteorologists are more disposed to assign the causes of our weather to the vaster regions of the upper air. An international meteorological committee, to meet in London in September, has been appointed by the Commission, and is to give special attention to the polar theory. The progress of its labors will be followed with deep interest. There are few human activities which would not gain by the advance of meteorological science, and the future of aviation will be largely determined by it.

THE WORLD'S SUPPLY OF WHEAT

ACCORDING to a report issued to the Department of Agriculture prospects for the world's